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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[Docket No. 230613-0148; RTID 0648-XR128]

Endangered and Threatened Wildlife; 90-Day Finding on a Petition To List the Bull Kelp as Threatened or Endangered Under the Endangered Species Act

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; 90-day petition finding.

SUMMARY: We, NMFS, announce a 90-day finding on a petition to list the bull kelp (*Nereocystis luetkeana*) as threatened or endangered under the Endangered Species Act (ESA) and to designate critical habitat concurrent with the listing. We have reviewed the information presented in the petition as well as information readily available in our files and find that the petition does not present substantial scientific or commercial information indicating that the petitioned actions may be warranted. Therefore, we are denying this petition.

ADDRESSES: Interested persons may obtain a copy of the petition online at the NMFS website: *https://www.fisheries.noaa.gov/national/endangered-species-conservation/negative-90-day-findings*.

FOR FURTHER INFORMATION CONTACT: Melissa Neuman, NMFS West Coast Region, Protected Resources Division, (562) 481-4594, *Melissa.Neuman@noaa.gov*.

SUPPLEMENTARY INFORMATION:

Background

On September 1, 2022, we received a petition from the Center for Biological Diversity to list the bull kelp (*Nereocystis luetkeana*) as a threatened or endangered species under the ESA and to designate critical habitat concurrent with the listing. The

petition asserts that the bull kelp is threatened by all of the ESA section 4(a)(1) factors: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; and (5) other natural or manmade factors affecting its continued existence. The petition is available online (see **ADDRESSES**).

ESA Statutory, Regulatory, and Policy Provisions and Evaluation Framework

Section 4(b)(3)(A) of the ESA of 1973, as amended (16 U.S.C. 1531 *et seq.*), requires, to the maximum extent practicable, that within 90 days of receipt of a petition to list a species as threatened or endangered, the Secretary of Commerce shall make a finding on whether that petition presents substantial scientific or commercial information indicating that the petitioned action may be warranted, and promptly publish such finding in the **Federal Register** (16 U.S.C. 1533(b)(3)(A)). If NMFS finds that substantial scientific or commercial information in a petition indicates the petitioned action may be warranted (a "positive 90-day finding"), we are required to promptly commence a review of the status of the species concerned, during which we will conduct a comprehensive review of the best available scientific and commercial data. We conclude the review with a finding as to whether, in fact, the petitioned action is warranted within 12 months of receipt of the petition. Because the finding at the 12-month stage is based on a more thorough review of the best available information, as compared to the narrow scope of review at the 90-day stage, a "positive 90-day" finding does not prejudge the outcome of the status review.

Under the ESA, a listing determination may address a species, which is defined to also include subspecies and, for any vertebrate species, any distinct population segment (DPS) that interbreeds when mature (16 U.S.C. 1532(16)). A species, subspecies, or DPS is "endangered" if it is in danger of extinction throughout all or a significant portion of its

range, and "threatened" if it is likely to become endangered within the foreseeable future throughout all or a significant portion of its range (16 U.S.C. 1532(6) and (20)). Pursuant to the ESA and our implementing regulations, we determine whether species are threatened or endangered based on any one or a combination of the following five ESA section 4(a)(1) factors: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; and (5) other natural or manmade factors affecting its continued existence (16 U.S.C. 1533(a)(1); 50 CFR 424.11(c)).

ESA-implementing regulations issued jointly by NMFS and the U.S. Fish and Wildlife Service (50 CFR 424.14(h)(1)(i)) define "substantial scientific or commercial information" in the context of reviewing a petition to list, delist, or reclassify a species as credible scientific or commercial information in support of the petitioner's claims such that a reasonable person conducting an impartial scientific review would conclude that the action proposed in the petition may be warranted. Conclusions drawn in the petition without the support of credible scientific or commercial information will not be considered substantial information. In reaching the 90-day finding on the petition, we considered the information described in sections 50 CFR 424.14(c) and (d).

Our determination as to whether the petition provides substantial scientific or commercial information indicating that the petitioned action may be warranted depends in part on the degree to which the petition includes the following types of information: (1) information on current population status and trends and estimates of current population sizes and distributions, both in captivity and the wild, if available; (2) identification of the factors under section 4(a)(1) of the ESA that may affect the species and where these factors are acting upon the species; (3) whether, and to what extent, any or all of the factors alone or in combination identified in section 4(a)(1) of the ESA may

cause the species to be an endangered species or threatened species (*i.e.*, the species is currently in danger of extinction or is likely to become so within the foreseeable future), and, if so, how high in magnitude and how imminent the threats to the species and its habitat are; (4) information on adequacy of regulatory protections and effectiveness of conservation activities by States, as well as other parties, that have been initiated or that are ongoing, that may protect the species or its habitat; and (5) a complete, balanced representation of the relevant facts, including information that may contradict claims in the petition. See 50 CFR 424.14(d).

If the petitioner provides supplemental information before the initial finding is made and states that it is part of the petition, the new information, along with the previously submitted information, is treated as a new petition that supersedes the original petition, and the statutory timeframes will begin when such supplemental information is received. See 50 CFR 424.14(g).

We may also consider information readily available at the time the determination is made (50 CFR 424.14(h)(1)(ii)). We are not required to consider any supporting materials cited by the petitioner if the petitioner does not provide electronic or hard copies, to the extent permitted by U.S. copyright law, or appropriate excerpts or quotations from those materials (*e.g.*, publications, maps, reports, letters from authorities). See 50 CFR 424.14(c)(6); 424.14(h)(1)(ii).

The substantial scientific or commercial information standard must be applied in light of any prior reviews or findings we have made on the listing status of the species that is the subject of the petition (50 CFR 424.14(h)(1)(iii)). Where we have already conducted a finding on, or review of, the listing status of that species (whether in response to a petition or on our own initiative), we will evaluate any petition received thereafter seeking to list, delist, or reclassify that species to determine whether a reasonable person conducting an impartial scientific review would conclude that the

action proposed in the petition may be warranted despite the previous review or finding. Where the prior review resulted in a final agency action—such as a final listing determination, a 90-day not-substantial finding, or a 12-month not-warranted finding—a petition will generally not be considered to present substantial scientific and commercial information indicating that the petitioned action may be warranted unless the petition provides new information or analysis not previously considered. 50 CFR 424.14(h)(1)(iii).

At the 90-day finding stage, we do not conduct additional research and we do not solicit information from parties outside the agency to help us in evaluating the petition. We accept the petitioner's sources and characterizations of the information presented if they appear to be based on accepted scientific principles, unless we have specific information in our files that indicates the petition's information is incorrect, unreliable, obsolete, or otherwise irrelevant to the requested action. Information that is susceptible to more than one interpretation, or that is contradicted by other available information, will not be dismissed at the 90-day finding stage, so long as it is reliable and a reasonable person conducting an impartial scientific review would conclude it supports the petitioner's assertions. In other words, conclusive information indicating the species may meet the ESA's requirements for listing is not required to make a positive 90-day finding. We will not conclude that a lack of specific information alone necessitates a negative 90-day finding if a reasonable person conducting an impartial scientific review would conclude that the unknown information itself suggests the species may be at risk of extinction presently or within the foreseeable future.

To make a 90-day finding on a petition to list a species, we evaluate whether the petition presents substantial scientific or commercial information indicating the subject species may be either a threatened or endangered species, as defined by the ESA. First, we evaluate whether the information presented in the petition, in light of the information

readily available in our files, indicates that the petitioned entity constitutes a ''species'' eligible for listing under the ESA. Next, we evaluate whether the information indicates that the species faces an extinction risk such that listing may be warranted; this may be indicated in information expressly discussing the species' status and trends, or in information describing impacts and threats to the species. We evaluate whether the petition presents any information on specific demographic factors pertinent to evaluating extinction risk for the species (*e.g.*, population abundance and trends, productivity, spatial structure, age structure, sex ratio, diversity, current and historical range, habitat integrity or fragmentation), and the potential contribution of identified demographic risks to extinction risk for the species. We then evaluate whether the petition presents information suggesting potential links between these demographic risks and the causative impacts and threats identified in section 4(a)(1) of the ESA.

Information presented on impacts or threats should be specific to the species and should reasonably suggest that one or more of these factors may be operative threats that act, or have acted, on the species to the point that it may warrant protection under the ESA. Broad statements about generalized threats to the species, or identification of factors that could negatively impact a species, do not constitute substantial information indicating that listing may be warranted. We look for information indicating that not only is the particular species exposed to a factor, but that the species may be responding in a negative fashion. We then assess the potential significance of that negative response.

Many petitions identify risk classifications made by nongovernmental organizations, such as the International Union for Conservation of Nature (IUCN), the American Fisheries Society, or NatureServe, as evidence of extinction risk for a species. Risk classifications by other organizations or made under other Federal or State statutes may be informative, but such classification alone may not provide the rationale for a positive 90-day finding under the ESA. For example, as explained by NatureServe, their

assessments of a species' conservation status do "not constitute a recommendation by NatureServe for listing under the U.S. Endangered Species Act" because NatureServe assessments "have different criteria, evidence requirements, purposes and taxonomic coverage than government lists of endangered and threatened species, and therefore these two types of lists should not be expected to coincide" (*https://explorer.natureserve.org/AboutTheData/DataTypes/ConservationStatusCategories*). Additionally, species classifications under IUCN and the ESA are not equivalent; data standards, criteria used to evaluate species, and treatment of uncertainty are also not necessarily the same. Thus, when a petition cites such classifications, we will evaluate the source of information that the classification is based upon in light of the standards on extinction risk and impacts or threats discussed above.

Taxonomy

Bull kelp, *Nereocystis luetkeana*, is a large brown alga in the kingdom Chromista (single-celled and multicellular eukaryotes with photosynthetic plastid organelles), phylum Gyrista, class Phaeophyceae (brown algae), and order Laminariales (the true kelps). Laminariales contains three families: Alariaceae, Laminariaceae, and Lessoniaceae. Traditional taxonomy, largely based on sporophyte morphology, was used to differentiate the brown algae and resulted in the placement of bull kelp into the family Lessoniaceae (Springer et al. 2007). In recent years, molecular techniques and resulting genetic data have challenged traditional taxonomy within the order resulting in a taxonomic revision at the family level based on evolutionary relationships (Lane et al. 2006). Bull kelp is now in the family Laminariaceae, not Lessoniaceae as the petitioner stated, and it is the only species within its genus, *Nereocystis*.

Distribution, Habitat, and Life History

Bull kelp is an annual marine macroalgal species that attaches to rocky substrates using its holdfast in intertidal and subtidal coastal habitats in the Northeastern Pacific

Ocean from the Aleutian Islands, Alaska, to Santa Barbara County, California (Springer et al. 2010). Bull kelp typically occupies turbulent habitats between 3-20 m depth, and it can co-occur with other large brown kelps including dragon kelp (*Eularia fistulosa*) and giant kelp (*Macrocystis pyrifera*). It is considered to be a foundational species because it provides habitat for a variety of other marine organisms.

Bull kelp reproduces sexually. Adults, also known as sporophytes, become mature during the summer or fall seasons at which time patches of spores, called sori, form on the kelp blades. Sori are shed around dawn and are negatively buoyant, causing them to sink. The sori release individual spores into the water column as they sink and upon reaching the substrate for up to approximately four hours. During this stage, both sori and spores have the capacity for dispersal, but the temporal and spatial scale of dispersal has not been quantified to date (Springer et al. 2010). Spores have limited ability to photosynthesize and therefore are likely not adapted for a long planktonic life. Given the suspected limited dispersal distances, spores are thought to settle near adults. Individual sporophytes have the ability to produce and release sori in pulses that occur every 4-6 days with a periodicity that varies by geographic location.

Spores that successfully settle germinate into microscopic, sessile, male or female gametophytes. It is uncertain how long the gametophyte stage persists and the length of the stage is likely affected by abiotic conditions such as light, nutrients, and storm events (Springer et al. 2007). Based on laboratory studies, gamete production by gametophytes occurs at water temperatures between 5-15 ^{o}C, but when temperatures are sustained at greater than 20 ^{o}C, morphological abnormalities in gametophytes and gametes are observed (Vadas 1972). Prevailing knowledge suggests that male gametophytes fertilize the female gametophytes in the winter. Increased proximity of male and female gametophytes increases fertilization success as does a pheromone released by female gametophytes known as lamoxirene. Fertilized eggs begin to grow into sporophytes in the

spring as sunlight hours increase (Maier and Muller 1986). As the spring growing season progresses, macroscopic sporophytes can grow between 6-15 cm per day until the blades reach the water surface during the summer months (Springer et al. 2010 referencing Scagel 1946, Lindeberg and Lindstrom 2010). At this point, growth slows and the sporophyte diverts its energy to producing spores. Typically, the life of an individual sporophyte ends at this point, but Springer (2010) referring to (Chenelot et al. 2001) points out that individuals produced late in the season in shallow water or wave-protected areas may successfully overwinter and survive a second year.

Status and Population Trends

Alaska

The petitioner cites Krumhansl et al. (2016) when stating that population trends of kelp are negative in the Aleutian Islands and that bull kelp is the primary kelp species in this region. We did not find evidence that Krumhansl et al. (2016) identified bull kelp as the primary kelp species in the ecoregion that they refer to as the Aleutian Islands. The authors examined an overall trend for eight species, including bull kelp, but did not identify species-specific trends. Information provided by the petitioner (PNW Herbaria Map, Springer et al. 2010) and readily available in our files suggests that bull kelp occurs in an area that constitutes less than a third of the Aleutian Island chain and bull kelp does not occur west of the Samalga Pass, a natural, historic biogeographic barrier to bull kelp colonization (Konar et al. 2017). Throughout the remaining two thirds of the Aleutian Island chain, dragon kelp, *Eualaria fistulosa,* is the dominant kelp canopy species and it was part of the species complex examined is the Aleutian Islands ecoregion by Krumhansl et al. (2016). Therefore, the petitioners are incorrect in suggesting that the long-term trend observed for the Aleutian Island ecoregion is due to bull kelp declines.

Krumhansl et al. (2016) inferred relatively high magnitude increases in kelp abundance for the Gulf of Alaska and the North American Pacific Fjordland. Bull kelp is

the dominant kelp canopy species in these regions, occurring throughout both regions with no major breaks in distribution (*https://www.shorezone.org/*). In this case, it is reasonable to assume that bull kelp contributed significantly to increasing long-term trends observed by Krumhansl et al. (2016).

In summary, the overall status of bull kelp in Alaska indicates that populations have increased along the portion of the coastline where bull kelp occurrence is consistent and known (Gulf of Alaska and the North American Pacific Fjordland; Krumhansl et al. 2016). In the Aleutian Islands, where bull kelp is not a primary kelp species and has only been observed in an area that comprises < 33% of the ecoregion, long-term trends remain uncertain.

Canada

The literature cited in the petition and the information we have readily available in our files present limited evidence of bull kelp decline in Canadian waters based on long-term trend studies conducted off the West Coast of North America. Krumhansl et al. (2016) inferred relatively high magnitude increases in kelp abundance for the North American Pacific Fjordland from 1983-2012, and it is reasonable to assume that bull kelp contributed to this increasing trend because it occurs throughout the ecoregion with no breaks in its distribution. Schroeder et al. (2019) found limited evidence of bull kelp decline in British Columbia from 2004-2017, a time period that pre-dates and follows the marine heat wave of 2014-2016. In a shorter-term study along the central coast of British Columbia, Burt et al. (2018) found fluctuating kelp canopy cover that may have been related to predator/prey interactions and found no evidence for kelp decline over the time period they examined (2006, 2012, 2014-2016).

In a study focusing on Barkley Sound, an area that comprises ~0.3% of the Canadian coastline on the west coast of Vancouver Island, Starko et al. (2022) examined local impacts to kelp (both giant and bull kelp) during the 2014-2016 marine heatwave.

Nearly all kelp forests persisted toward the cool outer coast, but extensive kelp loss was observed inshore where surface water temperatures were > 3°C warmer. The authors concluded that the responses of kelp forests to warm water events are highly variable at local scales with areas experiencing loss only 2-3 km away from areas where kelp was resilient.

In summary, long-term data suggest that bull kelp populations in Canada appear stable or increasing in most areas, especially on the outer coast. Very small areas that tend to be inshore and constitute < 1% of the range of the species in Canada experienced declines during the marine heatwave of 2014-2016. These localized declines were not significant enough to change the outcome of longer-term studies that suggest stability or increases of bull kelp in Canada or across its range.

Washington

The petitioner states that bull kelp decline in Washington is associated with warmer water temperatures and proximity to human populations (Pfister et al. 2018). The information in our files suggests that Puget Sound bull kelp populations have experienced major losses since the late 1800s; population declines of 96 percent and 83 percent were reported in the Central and West sub-basins, respectively (Berry et al. 2021). This pattern of decline did not hold true for the Strait of Juan de Fuca at the entrance to the Salish Sea where the bull kelp forest has generally remained stable over the last century, except along the eastern boundary of the Strait (Pfister et al. 2018). Krumhansl et al. (2016) found no directional trend over a 30-year time frame in the larger ecoregion they studied, which encompassed Washington. Furthermore, bull kelp populations on the outer coast of Washington have remained stable or increased since the 1990s (Pfister et al. 2017). Berry et al. (2021) noted that these contrasting patterns of adjacent sub-regions experiencing loss and stability have occurred in other locations globally.

The petitioner does not comment specifically about how the bull kelp forests in Washington responded to the marine heat wave of 2014-2016. Information in our files suggests that sites along Washington's outer coast and in the Strait of Juan de Fuca experienced a ~50 percent decline of their predominantly bull kelp canopy during the marine heat wave, but that the canopy quickly recovered and stipe density increased after 2015 (Tolimieri et al. 2023). In summary, long-term data suggest that bull kelp populations along the outer coast of Washington and in the Strait of Juan de Fuca (except along the eastern boundary) are stable or increasing following the marine heat wave, while populations in Puget Sound are in decline. There is no evidence presented by the petitioners or that we have readily available in our files that these small areas of decline had an impact on the status or health of the species in Washington or throughout its range.

Oregon

The petitioner does not specifically mention the status of bull kelp populations in Oregon, where bull kelp is the dominant canopy kelp species. Long-term data in our files suggest variable trends between 1984-2018 according to one study (Hamilton et al. 2020) and a 0.8 percent decline between 1984-2021 according to another study that is in review (Bell et al. in review). Both studies found that the marine heat wave of 2014-2016 had little effect on bull kelp populations in Oregon, and that bull kelp beds in Oregon appear to be more resistant to the heat wave events compared to other areas (Hamilton et al. 2020, Bell et al. in review). Resilience among the kelp beds of Oregon was variable, but overall positive, between 2014-2016. In some areas, population sizes grew to higher levels compared to those recorded prior to the heat wave (Rogue Reef) and others remained stable (Orford Reef; Hamilton et al. 2020).

In summary, long-term data suggest that bull kelp populations in Oregon have fluctuated over time, with periods of stability, declines, and increases depending on the

particular area being studied. Oregon populations also appear to be fairly resilient to the marine heat wave of 2014-2016.

Northern California

The petitioner cites a negative kelp canopy population trend in Northern and Central California from 1973-2012 and references Krumhansl et al. (2016), who do not distinguish which kelp species, of the 14 examined, are responsible for the negative trend observed. The petitioner claims that a negative trend in multi-species (both canopy and understory) kelp decline indicates a species-specific decline in bull kelp within Northern and Central California. This claim is misleading because there are two dominant kelp canopy species along the Northern and Central California coasts, and they are not distributed evenly across this large ecoregion. Bull kelp is the predominant canopy forming species in Northern California, and giant kelp is the predominant species in Central California. Krumhansl et al. (2016) estimated a decline of 2% in kelp abundance per year in this large region that encompasses all of Northern and Central California; however, it is not known which species are driving the downward trend and it is not reasonable to assume that each canopy species contributed to this decline equally because they are not distributed equally across the entire area. Bell et al. (in review) examined trends in bull kelp-dominated Northern California. They found no significant long-term trend in bull kelp abundance based on kelp canopy cover from the 1980s to present at 80 percent of the sites they studied. They did observe large fluctuations in kelp canopy in Northern California throughout the time period, emphasizing that high variability in abundance is characteristic of bull kelp populations in this region.

The petitioner states that there have been alarming bull kelp population declines since 2014 following the marine heat wave in Sonoma and Mendocino counties where the canopy has declined by 90 percent and kelp have not recovered as expected (Rogers-Bennett & Catton 2019, Finger et al. 2021, Bell et al. in review). We have corroborated

this claim based on the information provided by the petitioner and the information we have in our files (McPherson et al. 2021, Ward et al. 2022). Bell et al. (in review) found low resistance and resilience of bull kelp populations in Northern California following the marine heat wave of 2014-2016, but documented signs of recovery began in 2021. Resistance was defined as the degree to which bull kelp canopy area changed during and shortly following the marine heat wave (2014-2016) relative to the baseline period immediately preceding the heatwave event (2009-2013) and resilience was defined as the degree to which bull kelp canopy area recovered following the marine heat wave (2017-2021) relative to the baseline period (Bell et al., in review).

In summary, long-term data presented in the petition and/or readily available in our files suggest no significant trend in bull kelp populations in Northern California despite significant declines in Sonoma and Mendocino counties following the marine heat wave of 2014-2016. In addition, there are signs of very slow recovery in Sonoma and Mendocino counties beginning in 2021 (Bell et al., in review). There is no evidence presented by the petitioners, or that we have readily available in our files, that the small areas of decline in Sonoma and Mendocino counties (~10% of the species' range) are having an impact on the status or health of the species in other areas of Northern California or throughout the bull kelp range.

Central California

As noted above for *Northern California*, Krumhansl et al. (2016) combined Northern and Central California together as well as combining trends for 14 species of kelp, both canopy-forming and understory species, to estimate a decline of 0.02 in kelp abundance per year in this region between 1973-2012. It is not known which species are driving the downward trend. Bull kelp is not distributed evenly across the ecoregion that includes both Northern and Central California, and giant kelp is the predominant species in Central California. Bell et al. (in review) examined trends in kelp canopy in Central

California from 1984-2021 and found a decline of 0.06 percent per year, but the authors indicate that declines in giant kelp, not bull kelp, were primarily responsible for driving this downward trend. Bell et al. (in review) found that resistance and resilience of the kelp canopy were relatively high following the 2014-2016 marine heat wave, but again there is no evidence that these metrics can be applied to bull kelp specifically.

In summary, the predominant canopy-forming kelp in this region is giant kelp, not bull kelp, so long-term studies of kelp canopy in this area do not directly inform the status of bull kelp in Central California. The petitioners provide no evidence, and we have no information readily available in our files suggesting a decline in the status of bull kelp in Central California.

Overall Status and Trend

While the petitioner claims that alarming declines in bull kelp populations are occurring throughout the species' range, they fail to provide substantial scientific or commercial information indicating that bull kelp may be declining and may warrant listing based on status throughout all or a significant portion of its range. Bell et al. (in review) conclude that long-term, continuous datasets spanning 40 years or more are necessary to put short-term declines in canopy kelp populations into the context of long-term dynamics. In addition, studies examining the waxing and waning of bull kelp populations at local scales and over short periods of time (i.e. up to several years) found that factors thought to be responsible for declines do not operate equally throughout the bull kelp range. Declines occurring in a small portion of the bull kelp range over short-term time frames are not indicative of long-term status across the species' range or in a significant portion of the range.

The data that the petitioner cites and that we have in our files suggest stable or increasing bull kelp populations are present in the northern (i.e., Alaska) and southern (i.e., Northern California) portions of the bull kelp range, as well as many areas in

between. The areas where bull kelp populations are stable or increasing comprise a large percentage of the species' range (~80%) and almost all populations from Alaska to Oregon appear to be resilient to marine heat waves, especially the most recent marine heatwave of 2014-2016. In Northern California, where bull kelp populations declined dramatically following the 2014-2016 marine heat wave, there is evidence of recovery beginning in 2021.

In sum, the status of bull kelp in geographic portions of its range indicates that bull kelp populations are predominantly stable or increasing throughout the range of the species as well as within significant portions of its range.

Analysis of ESA Section 4(a)(1) Factors

In the following sections, we summarize our evaluation of the information presented by the petition and readily available in our files regarding the specific ESA section 4(a)(1) factors (hereafter "listing factors") that may be affecting bull kelp's risk of extinction.

Present or threatened destruction, modification, or curtailment of its habitat or range

The petitioner states that climate change, specifically warming ocean temperatures, is the predominant threat to bull kelp across its range. The petitioner states that the marine heat wave of 2013 ("The Blob") followed by the strong 2015/2016 El Niño event resulted in unprecedented sea surface temperature increases that caused bull kelp populations to crash. The petitioner asserts that bull kelp's apparent failure to recover to pre-Blob levels of canopy coverage indicates that bull kelp lacks resilience and resistance to temperature increases, thus providing a snapshot into what a warmer future looks like as climate change worsens. However, the information provided with the petition and in our files suggest that as an annual species, bull kelp regularly undergoes boom and bust cycles as part of its life history, and therefore some degree of fluctuation in abundance year to year is expected. Furthermore, bull kelp has persisted through

several intense El Niño events historically. The marine heatwave of 2014-2016 affected bull kelp in some areas across its range, with variability in response over small spatial and temporal scales.

The petitioner did not present long-term trends in abundance or distribution for bull kelp across its entire range; they relied heavily on Bell et al. (in review), who used land-sat images to examine long-term trends in kelp canopy cover (both *N. luetkeana* and *M. pyrifera)* in regions from Oregon to Baja California. This study found a strong latitudinal response to the heatwave event, with high spatial variability in recovery that included considerable small-scale (meters to kilometers) local effects. Overall, in this study, both resilience and resistance to the heat wave increased with increasing latitude; from Northern California to Oregon (bull kelp dominated areas) and Baja California Sur to Central California (giant kelp dominated areas). In response to the most recent heatwave event, kelp canopies in Oregon were highly variable, with some areas showing less than 10% recovery and some as high as 1400% of baseline levels. Kelp forests in Northern California exhibited historic lows during and post-marine heatwave (2014-2021), although no long-term regional decline (i.e., no trend) was detected in the overall time series (1984-2021). In contrast, kelp forests in Central California showed a significant long-term regional decline, driven by large decreases in canopy cover around the Monterey Peninsula, where giant kelp, not bull kelp, is the dominant canopy species.

Other studies on kelp forests across latitudinal gradients found increasing temperatures did not change kelp canopy cover biomass, but instead showed temperature-driven alteration in physiological performance that led to the reduction of kelp bed resiliency. The petitioner cites Wernberg et al. (2010), who conducted disturbance experiments in 24 kelp forest reefs in four regions spanning temperatures of 2-4 ^{o}C in western Australia. In this study, there was no significant relationship between temperature and kelp canopy biomass across the temperature gradients and regions, but it

was found that kelps adjusted key metabolic processes in response to prevailing temperature. Physiological performance was reduced under warmer temperatures resulting in reduced reproduction, recruitment, and recruit survival compared to regions with cooler temperatures. As a consequence of low recruit abundance, kelp beds in northern latitudes (warmer water) had lower resilience to experimental perturbations compared to southern latitude kelp beds (colder water), suggesting there is an interaction between temperature regime and intensity of disturbance. The results of this study suggest that while kelp forest canopies may remain intact across latitudinal gradients, under warmer temperatures they may be more susceptible to other stressors like disease, poor water quality, reduced light levels, or physical disturbance, thereby diminishing their capacity for canopy regeneration in the long-term (Wernberg et al. 2010).

Additional information present in our files and provided by the petitioner shows that microclimate and other local scale effects play important roles in mediating bull kelp resilience across its range. A study by Starko et al. (2022) in Barkley Sound, British Columbia, an area that comprises ~0.3% of the Canadian coastline, examined the role of fine-scale environmental variation (i.e., microclimate) in the indirect and direct effects of the 2014-2016 North Pacific heatwave on the persistence of the Pacific's predominant canopy-forming species, bull kelp and giant kelp. The authors demonstrated kelp forests went locally extinct as a result of the heatwave at 40 percent of the sites surveyed in that area, with most losses occurring at inshore sites that experienced the warmest temperatures. However, despite extirpation in these inshore areas, the authors found that kelp forests offshore persisted in deeper, cooler, nutrient-rich waters. This thermal refugia was limited by urchin grazing pressure at greater depths, but it was also found that some of the warmer inshore areas provided refuge from urchins depending on substrate type. This demonstrates how microclimate and grazing pressure may interact to influence kelp

forest occupancy in a system, and despite warming waters, microhabitats that support kelp forests can still persist.

Other studies support the importance of microclimates in driving kelp forest dynamics. For example, Schroeder et al. (2019) found that spatial and temporal persistence of bull kelp along the west coast of British Columbia varied with the local effects of current speed, temperature, and substrate type, with greater persistence in areas with higher currents and rockier substrates. Beas-Luna et al. (2020) examined kelp forest communities from Alaska to Baja California, Mexico, and found that local factors such as species composition, local oceanographic conditions, and human activities led to different patterns of kelp forest community response to climate change along the west coast of North America, with greater changes observed in the southern portions of the range, and more resilience in the central and northern portions where bull kelp is the dominant canopy forming species. In a global review, Krumhansl et al. (2016) analyzed global kelp forest change in ecoregions with data from the past 50 years and also concluded that local factors play a dominant role in driving kelp forest dynamics. Based on the literature in our files and provided by the petitioner, bull kelp population trajectories vary in direction and magnitude among ecoregions or microclimates rather than on broad spatial scales, with some areas exhibiting decline in biomass and other areas remaining stable or even increasing.

In summary, the information presented by the petitioner and literature in our files provides evidence that warming ocean temperatures associated with marine heatwaves and climate change has resulted in bull kelp decline in some spatially limited areas. However, overall, bull kelp canopy recovery following warming events is spatially variable and often driven by a suite of local environmental factors. According to long-term, species-specific, ecoregional trend data (30+ years), the best type of data for providing insight into species resilience over time, bull kelp is increasing or stable in

areas that span its extensive range, including those that have been impacted by warm-water induced declines. Therefore, we do not find that there is substantial information indicating that warm water events and climate change may be contributing to extinction risk for the bull kelp now or in the foreseeable future.

Overutilization for commercial, recreational, scientific or educational purposes

The petitioner asserts that commercial bull kelp harvesting threatens the survival of bull kelp given that kelp harvest methods can include harvesting the upper portion of the kelp that helps keep it buoyant. The petitioner claims these methods can also inhibit the capacity for reproduction. The petitioner cites recent limits and closures of bull kelp harvest in California as evidence that additional measures are needed to protect bull kelp. Springer et al. (2010) outlines the regulatory framework and limitations on bull kelp harvesting in California, Oregon, Washington, British Columbia, and Alaska. There are restrictions or prohibitions on commercial harvest throughout the range of bull kelp, and historically there has been relatively limited commercial harvest (Springer et al. 2010). There are also restrictions on the harvest amount and/or allowable location of bull kelp harvest for personal, recreational, and scientific use throughout California, Oregon, Washington, British Columbia, and Alaska, including license/permit requirements for these non-commercial activities in most areas (Springer et al. 2010). While the petitioner does raise some concern about overutilization based on the general nature of harvest, the petitioner admits that the quantity of harvest is not a threat, and this factor does not appear to weigh heavily or factor into the petitioner's summary explanation of why bull kelp may warrant listing under the ESA. The information presented in the petition and available in our files does not indicate that harvest for commercial, personal, recreational, and scientific use is a threat to bull kelp.

While not discussed or referenced by the petitioner, information in our files indicates that aquaculture production of bull kelp has recently developed or is being

actively pursued for commercial and restoration uses in Washington and Alaska (*https://www.fisheries.noaa.gov/national/aquaculture/seaweed-aquaculture*). These aquaculture activities are closely regulated by the states of Washington and Alaska, with additional federal and/or local requirements that may apply for such facilities and operations. Bull kelp grown in aquaculture provides some of the ecosystem services of wild populations such as carbon sequestration, nitrogen removal, providing habitat for fish, invertebrates, and other fauna, and dissipation of wave energy. Currently, NMFS does not consider kelp aquaculture to be a threat to wild populations of bull kelp.

Disease or predation

The petitioner asserts that predation by sea urchins poses a threat to bull kelp. The petitioner identifies trophic imbalances associated with the loss of urchin predators, such as the sea otter and sunflower sea star, as a factor that can devastate the bull kelp ecosystem and lead to the development of urchin barrens. Urchin barrens may form when urchin herbivory results in kelp deforestation and a community dominated by crustose coralline algae. They assert that urchin barrens have occurred along the North American west coast, from north of San Francisco to the Oregon border. Although urchin predation has been attributed as one of the primary stressors to kelp in Mendocino and Sonoma counties in Northern California, Hamilton et al. (2020) demonstrated that Oregon bull kelp population sizes were not significantly affected by the increase in urchin density that occurred in connection with the 2014 marine heat wave. Bull kelp have persisted in Oregon despite the functional extinction of sea otters and recent decline in sunflower sea stars (Hamilton et al. 2020). Similarly, Tolmieri et al. (2023) did not observe a strong, negative correlation between urchins and canopy kelp species in Washington.

The petitioner asserts that urchin barrens may become alternate stable-states of the ecosystem in which a return to a kelp forest state would be difficult. Although the development of alternate stable-states may occur, there is significant spatiotemporal

variation in the ecological processes that sustain such states. For example, pathogen induced sea urchin mortality has resulted in repeated flipping between kelp forests and urchin barrens in Nova Scotia. Pathogen-induced sea urchin mortality has also been observed in California (Steneck and Johnson, 2013). In addition, urchin biomass removal due to a directed fishery or as a kelp restoration action may shift barrens back to kelp forest communities (Steneck and Johnson, 2013, Williams et al. 2021, Eger et al. 2022).

The petitioner also claims that sea urchin predation will be worsened by climate change due to reductions in kelp density associated with increased and stronger storm systems. They claim that a decrease in kelp density would increase predation from sea urchins. Although strong storm events have the potential to reduce the size of kelp forests, bull kelp has been observed to rapidly recolonize disturbed areas following removal of more competitively dominant algal species (Springer et al., 2010). Thus, in some cases, storm energy may have a positive effect on bull kelp abundance. In contrast to the above assertion, Dayton et al. (1992) noted an increase in urchin predation in response to the loss of drift kelp, not a decrease in kelp density.

The petition presents credible information that predation by sea urchins has created barrens in some areas. However, the long-term data readily available in our files suggest that bull kelp is actually increasing or stable within regions that encompass those smaller areas that have been impacted by localized urchin predation. Therefore, we conclude that the petition does not present substantial information indicating that disease or predation is posing a threat to bull kelp such that it is contributing to extinction risk.

Inadequacy of existing regulatory mechanisms

The petitioner asserts the existing regulatory mechanisms are insufficient to protect bull kelp from extinction and that bull kelp does not currently hold protected status under any environmental law. The only regulatory mechanism identified by the petitioner is that provided by the National Marine Sanctuary System, and they assert that

such protections are only provided in the southernmost part of the bull kelp habitat range. The petitioner incorrectly asserts that there are no National Marine Sanctuaries in Washington. To the contrary, the Olympic Coast National Marine Sanctuary includes 3,188 square miles of marine water including the nearshore waters off the Olympic Peninsula in the State of Washington. The petitioner does not specify particular threats for which existing regulatory mechanisms are inadequate and does not provide substantial scientific or commercial information to support their assertion. Given this lack of specificity, we note below some of the existing regulatory mechanisms that address manmade factors identified elsewhere in the petition.

Although the petitioner asserts that bull kelp does not currently hold protected status under any environmental law, they note elsewhere in the petition that the California Fish and Game Commission approved a 3-year temporary closure of bull kelp commercial harvest off Sonoma and Mendocino counties in California, and limited harvest off Humboldt and Del Norte counties. This is a regulatory mechanism designed to protect against an overutilization threat. We also note that the State of California has initiated the development of a statewide, climate-ready Kelp Restoration and Management Plan for California, which will include a harvest management framework and other fishery management plan elements required by the State of California's Marine Life Management Act, an innovative framework for ecosystem-based management of kelp forests, and a restoration toolkit consisting of restoration options available to resource managers in California. In addition, as described previously in *Overutilization for commercial, recreational, scientific or educational purposes*, there are management frameworks for bull kelp in place throughout its range that regulate the harvest and/or use of bull kelp for any purpose.

The U.S. Army Corps of Engineers South Pacific Division also considers kelp to be a special aquatic site (40 CFR 230 Section 404(b)(1) Guidelines). This status provides

special consideration when evaluating permit applications for dredged or fill material pursuant to Section 404 of the Clean Water Act. This is a regulatory mechanism that can address aspects of the coastal darkening factor identified in *Other natural or manmade factors affecting the bull kelp's continued existence* section of the petition. In addition, canopy kelp, which includes bull kelp, has been designated as essential fish habitat (EFH) pursuant to the Magnuson-Stevens Fishery Conservation and Management Act for various federally managed fish species under the Pacific Coast Groundfish (PCG) and Pacific Coast Salmon (PCS) Fishery Management Plans (FMPs). Moreover, canopy kelp has been designated as a habitat area of particular concern (HAPC) for various fish species under the PCG and PCS FMPs. Federal agencies must consult with NMFS regarding any proposed action that may adversely affect EFH or a HAPC, and must consider NMFS's conservation recommendations to mitigate any environmental impacts to bull kelp during construction and other development.

We conclude that the information presented in the petition and readily available to us does not constitute substantial information indicating that the inadequacies of existing regulatory mechanisms are posing a threat to bull kelp. To the contrary, information readily available to us indicates a number of existing regulatory mechanisms which assist in kelp protection.

Other natural or manmade factors

The petitioner asserts that chemical pollution, thermal pollution, coastal darkening, and oil spills pose risks to bull kelp and place the species at risk of extinction. For example, the petitioner expresses concern that thermal pollution created by power plants can jeopardize reproduction of bull kelp. Though there are a few coastal power plants that continue to discharge warm water, California has established regulations that are phasing out once-through cooling water for energy production. In addition, the Diablo Canyon power plant in central California is currently scheduled for decommissioning and

is not anticipated to continue discharging warm water over the long term. San Onofre Nuclear Generating Station (SONGS) was the only other coastal power plant in California that discharged warm water in the vicinity of kelp habitat, but it is currently being decommissioned. Moreover, the California Coastal Commission required SONGS to provide compensatory mitigation for the adverse effects to kelp and the marine environment resulting in the largest artificial reef project on the West Coast of the United States. As such, it seems that the threat of thermal pollution by power plants has diminished substantially and there is no indication of that pattern reversing in the foreseeable future.

Similar to thermal pollution, the petitioner claims chemical pollution can inhibit kelp reproduction, settlement, and survival, citing evidence from California and for other kelp species in South America. The petition specifically cites concerns around the impacts of hydrazine and heavy metals on bull kelp, pollutants emerging from coastal factories, military bases, and airports. However, the petition did not provide substantial scientific or commercial information to support these assertions, such as documentation of existing overlap between sources of these chemical pollutants and bull kelp populations and associated negative impacts.

Coastal darkening, defined by the petitioner as a situation that arises when pollutants from coastal runoff physically block the sun, is claimed as a stressor inhibiting bull kelp photosynthesis, and thereby growth and maturation, as well as bull kelp recruitment. The evidence that coastal darkening affects photosynthesis cited by the petitioner is focused on a different species of kelp, although the petitioner does provide support for the negative impacts of turbidity on photosynthesis and recruitment in bull kelp specifically. Importantly, though, the petition does not present evidence that human activities causing coastal darkening within the range of bull kelp reduce photosynthesis and recruitment of bull kelp.

Finally, the petitioner presents evidence from laboratory studies and asserts that oil spills, which can expose bull kelp to petroleum and polycyclic aromatic hydrocarbons (PAHs) in particular, threaten growth and photosynthesis, thereby increasing extinction risk. This concern is specific to California and Alaska bull kelp habitats where oil and gas development occurs. While some studies have demonstrated negative effects of petroleum products on bull kelp, Springer et al. (2010) indicate that little is known about the effects of toxicants such as oil on bull kelp. For example, studies focused on the Exxon Valdez oil spill in Alaska compared bull kelp biomass and percent cover between oiled and control sites in Prince William Sound and found no evidence of detrimental effects of oil exposure (Springer et al. 2010). While oil spills are a threat to coastal ecosystems, the petition fails to present credible scientific or commercial information indicating that these forms of pollution are posing a threat to bull kelp.

Petition Finding

In conclusion, after reviewing the petition, the literature cited in the petition, and other information readily available in our files, we do not find there is substantial information indicating that bull kelp is declining throughout all or a significant portion of its range or that it is affected by threats throughout all or a significant portion of its range such that listing may be warranted. We therefore conclude the petition does not present substantial scientific or commercial information indicating that the petitioned action to list *N. luetkeana* as a threatened or endangered species may be warranted.

References Cited

A complete list of all references cited herein is available upon request (See **FOR FURTHER INFORMATION CONTACT**).

Authority: The authority for this action is the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.).

Dated: June 14, 2023.

Samuel D. Rauch, III,

Deputy Assistant Administrator for Regulatory Programs,

National Marine Fisheries Service.

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